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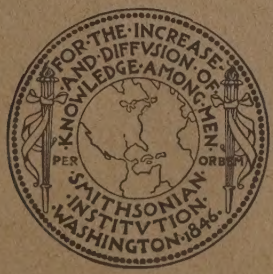
A REVIEW OF THE DRAGONETS (CALLIONYMIDÆ) AND RELATED FISHES OF THE WATERS OF JAPAN.

BY

DAVID STARR JORDAN
AND
HENRY W. FOWLER,
Of the Leland Stanford Junior University.

From the Proceedings of the United States National Museum, Vol. XXV, pages 939–959.

[No. 1305.]



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A REVIEW OF THE DRAGONETS (CALLIONYMIDÆ) AND RELATED FISHES OF THE WATERS OF JAPAN.

By David Starr Jordan and Henry W. Fowler,

Of the Leland Stanford Junior University.

In this paper is given an account of the *Callionymidæ* of Japan. It is based on specimens collected by Jordan and Snyder in the summer of 1900 and specimens collected by the U. S. Fish Commission steamer *Albatross*. Series are deposited in the United States National Museum and in the museum of Leland Stanford Junior University.

Two families may be recognized among the Japanese Dragonets:

a. Preopercle unarmed; opercle and subopercle rudimentary, each with a straightish, sharp spine; no lateral line; gill openings moderate ..... Draconettidæ, I.

aa. Preopercle with a long spine at its angle; opercle unarmed; lateral line present; gill openings very small ..... Callionymidæ, II.

Family I. DRACONETTIDÆ.

This family is allied to the *Callionymidæ*, differing very widely in the armature of the head, the preopercle being entire, the opercle and subopercle reduced, each consisting mainly of a nearly straight, sharp, simple spine. The gill openings are much wider than in *Callionymus*, but the gill membranes are broadly united to the isthmus. No lateral line. In spite of the singular armature of the head, this group probably belongs near to the *Callionymidæ*, which family it resembles in external characters. It has also much in common with *Bembrops* and *Pteropsaron*.

1. DRACONETTA Jordan and Fowler.

Draconetta Jordan and Fowler, new genus (*xenica*).

The characters of the genus are included above.

(*draconetta*, a quasi-Latin form of the English name Dragonet.)

1. DRACONETTA XENICA Jordan and Fowler, new species.

Head, 3½ in length; depth, 7; D. III–12; A., 12; P., 23; V. I, 5. Body elongate, compressed in front, and with the greatest depth about the anterior dorsal region, the trunk more or less rounded, and tapering behind. Head moderately large, compressed above so that its greatest

depth is two-thirds its width; the upper profile greatly inclined, a blunt angle forming over the eyes; snout pointed, compressed, its length two-thirds its width and also a little more than half the eye; eyes very large, superior, almost touching each other, directed upward, and about $2\frac{2}{3}$ in the head; mouth large, inferior, equal to the eye, and the maxillary extending for the first third of the eye; teeth in the jaws in villiform bands; the upper jaw protrudes but very slightly beyond the lower; edge of preoperculum entire; operculum and suboperculum each with strong spine posteriorly, the lower about in the middle of the height of body and the upper above and directed obliquely upward, with its posterior portion curved; top of the head striate behind the eyes. Gill opening rather broad.

Origin of spinous dorsal over that of the pectorals, the first spine the longest and equal to the space between the origins of the two pectorals, which is greater than the height of the body; soft dorsal much higher than the spinous dorsal, its origin in advance of that of the

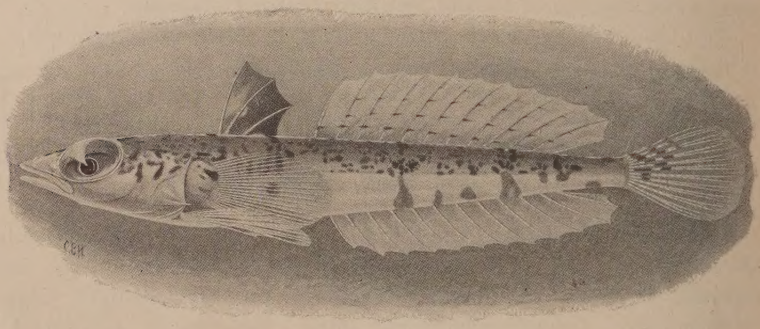

FIG. 1.—DRACONETTA XENICA.

anal; anal high, its base a little less than the soft dorsal; pectorals shorter than the head; ventrals jugular, shorter than the pectorals, not reaching the vent, and one-third as long again as the first dorsal spine; caudal fin long, equal to the ventral, and rounded. Caudal peduncle deeper than broad, its depth 2 in the eye.

Color in alcohol very pale brown, a little darker above, and mottled and spotted with dark brown; 5 rather indistinctly defined pairs of double dark-brown bars over the back; head spotted above; spinous dorsal blackish; soft dorsal and anal with several narrow, wavy, longitudinal bands; base of caudal spotted above; pectorals and ventrals plain, the former with a black spot at base; sides of the trunk behind the vent and below, with pale brown blotches; lower surface of the body anteriorly white.

Here described from a specimen $2\frac{9}{16}$ inches long, dredged at Station 3700, in Suruga Bay, at 100 fathoms, by the U. S. Fish Commission steamer *Albatross*.

This species is known to us from a single specimen 2½ inches long, No. 50816, U.S.N.M., dredged at Station 3700, in Suruga Bay, off Namazu, by the U. S. Fish Commission steamer *Albatross*, in 100 fathoms, in company with *Sphagebranchus moseri*.

(ξενικός, strange.)

Family II. CALLIONYMIDÆ.

DRAGONETS.

Body elongate, naked; head broad and depressed; the mouth narrow, the upper jaw very protractile; teeth very small, in jaws only; preopercle armed with a strong spine, opercle unarmed. Eyes moderate, usually directed upward. Lateral line present, often duplicated. Dorsal fins 2, or sometimes united at base; the anterior with 4 flexible spines; soft dorsal and anal short, the latter without distinct spine; ventrals I, 5, jugular in position, widely separated from each other; pectoral fins large. Gill openings small, the membranes broadly attached to the isthmus; gills 4, a slit behind the fourth; pseudobranchiæ present. No air bladder. Vertebræ usually 8 + 13 = 21. Sexes notably different in color. The dorsal fin higher in the male. Small fishes of the shores of warm seas, chiefly of the Old World, allied to the *Trachinidæ*, according to Boulenger, but resembling the *Cottidæ* in form.

a. Preopercular spine simple, sharp, spear-like, with serrate edge, but without recurved hooks above or at tip..... *Calliurichthys*, 2.

aa. Preopercular spine not simple, with recurved tip and with one or more recurved hooks above.

b. Ventrals entire, the outer ray not detached; head depressed; gill opening reduced to a very small foramen on upper surface of head; lateral line single. *Callionymus*, 3.

2. CALLIURICHTHYS Jordan and Fowler, new genus.

Calliurichthys Jordan and Fowler, new genus (*japonicus*).

This genus differs from *Callionymus* in the character of the preopercular spine, which is long, simple, straight or curved, and serrulate, but without recurved hooks above. A small antrorse spine at its base below. In the typical species the caudal fin is greatly elongate. The dorsal spines are graduated backward, at least the first two being elongate.

(κάλλις, beauty; οὐνά, tail; ἰχθύς, fish.)

a. Top of the head covered with rough bone.

b. Body very elongate, the head 3⅓ in length, the depth 10; top of head with two rough patches; caudal fin very long, especially in males; D. IV–9; A., 8. *japonicus*, 2.

bb. Body rather stout, the head about 2¾ in length, the depth 7¾; top of head with a single rough patch; D. IV–8; A., 7..... *variegatus*, 3.

aa. Top of head covered with smooth skin; head 3¼ in length, depth about 8½; D. IV–9; A., 9; dorsal spines much elongated..... *doryssus*, 4.

2. CALLIURICHTHYS JAPONICUS (Houttuyn).

YOMEGOCHI (BRIDE KOCHI).[1]

Callionymus japonicus HOUTTUYN, Verh. Holl. Maatsch. Wet. Harlem, XX, 1782, p. 311; Nagasaki.

Callionymus reevesi RICHARDSON, Voy. Sulphur, Fishes, 1844, p. 60, pl. XXXVI, figs. 1–3; Canton.—RICHARDSON, Ich. China, 1846, p. 210; Hongkong, Macao.—BLEEKER, Verh. Bat. Genoot., XXV, 1853, Nalez. Ich. Japan, p. 44; Nat. Tyds. Ned. Ind., V, 1853, Ceram, III, p. 244; China.

Callionymus longicaudatus SCHLEGEL, Fauna Japonica, Poiss., 1845, p. 151, pl. LXXIX, fig. 1; Nagasaki.—BLEEKER, Act. Soc. Sc. Indo-Neerl., III, 1857, Japan, IV, p. 17; Nagasaki.—GÜNTHER, Cat. Fish., III, 1861, p. 148; China.

Head $3\frac{1}{3}$ in length; depth 10; D. IV–9; A. 8; P. 20; V. I, 5. Body very elongate, much compressed in front, and with the greatest depth about the anterior dorsal region; trunk broader than deep, more or less rounded, and tapering backward. Head compressed above, so that its greatest depth is one-half its breadth; snout pointed, compressed above, the depth two-thirds the length, and a bony ridge forming directly in front of the eyes, but without a distinct bony ridge in

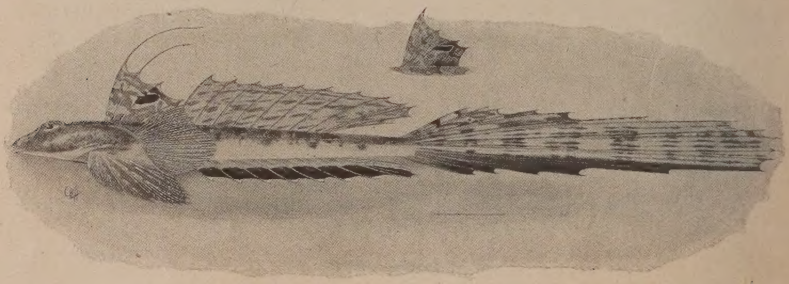

FIG. 2.—CALLIURICHTHYS JAPONICUS.

front of each nostril; eyes close together on top of the head, directed upward, $1\frac{1}{2}$ in the snout, 3 in the greatest width, and $4\frac{2}{3}$ in the length of the head; mouth small, inferior, the jaws equal, and the maxillary reaching the nostril; teeth minute, and in bands in the jaws; lower lips a little broad on each side; the preoperculum with a strong, sharp spine directed backward, in some examples a trifle longer than the eye, the upper edge with small sharp antrorse barbs, and the base in front with a short spine directed forward; top of the head with two elevated buckler-like crests, striate, and separated from each other by the smooth integument of the head. Gill openings small, round, on the upper surface of the body a short distance in front of the origin of the dorsal, as far apart as the space between the outer margins of

[1] Kochi (*gochi* in composition) is the vernacular name of all species of *Platycephalus*, and of *Callionymus*.

the eyes, and nearer the posterior margin of the latter than the origin of the pectoral.

Spinous dorsal inserted midway between or nearer the anterior margin of the eye and the origin of the soft dorsal, the spines slender, long, and the first two produced into long, thin filaments till the first is equal to two-fifths the length of the body; the dorsal spines are graduated from the first two, which are the longest; origin of the soft dorsal a little nearer the tip of the snout, and the base of the last anal ray of nearly uniform height, the last ray the longest and produced; anal originating under the second dorsal ray, lower than the soft dorsal, the last ray produced; pectorals between the origin of the spinous dorsal and that of the soft dorsal, broad, and forming an angle with the lower rays the shortest; ventrals large, broad, longer than the pectorals, originating before the gill opening but not reaching the tips of the pectorals, the rays graduated to the inner, which is the longest, and joined to the base of the pectoral in front by a broad membrane; caudal very long, strong, graduated above and below to the middle rays which are the longest, and equal to the body without snout. Caudal peduncle long, compressed, and the depth less than the eye.

Color of male in spirits, deep rich brown above, with numerous rounded spots and blotches of pale brown margined more or less with dark brown, and about six pale, rather broad cross bands; on the sides of the trunk are six dark brown blotches; lower surface of the body pure white, except a deep rich brown blotch on the chest; branchiostegals grayish-brown; spinous dorsal dark gray with a number of pale-gray blotches, and on the upper part posteriorly a larger jet black ocellus; soft dorsal grayish, with narrow bands of longitudinal brown blotches; anal with a broad black band along its lower margin; pectorals with pale spots above; ventrals gray-black with a few darker blotches, and the tips of the rays white; caudal edged with blackish broadly, deep below, and with about seven broad blackish cross bars. The female differs in having the dorsal spines short and not produced into filaments, and with the lower surface pure white without the deep brown blotch on the chest. This description from Wakanoura examples, the largest 11¼ inches long.

This species, remarkable for the great length of the caudal fin, is generally common in the bays of southern Japan. Our numerous specimens are from Nagasaki and Wakanoura. They agree with Richardson's plate of *Callionymus reevesi*, and the alleged distinction between Japanese and Chinese specimens mentioned by Bleeker seems to be without value.

3. CALLIURICHTHYS VARIEGATUS (Schlegel).

Callionymus variegatus SCHLEGEL, Fauna Japonica, Poiss., 1845, p. 153; Nagasaki.

Head $2\frac{2}{3}$ to $2\frac{7}{8}$ in length; depth $7\frac{1}{2}$ to $8\frac{1}{2}$; D. IV–8; A. 7; P. 17; V. I, 5. Body moderately elongate, much compressed, especially forward, and with the greatest depth about the anterior dorsal region; trunk broader than deep and tapering backward. Head compressed above so that its depth is $2\frac{1}{3}$ in its breadth; snout long, blunt, compressed, its width at the corners of the mouth a little more than the eye, its depth three-fifths its length, its greatest width equal to its length, and $2\frac{2}{3}$ in the head; a bony ridge in front of each eye, eyes close together, on top of the head, directed upward, $1\frac{1}{2}$ to 2 in the snout 3 to $3\frac{1}{2}$ in the greatest width, and $4\frac{1}{2}$ to 5 in the length of the head; mouth small, inferior, the upper jaw protruding and the maxillary reaching three-fourths to three-fifths in the space between the tip of the snout and the anterior margin of the eye; teeth in villiform bands in the jaws; lips rather thin,

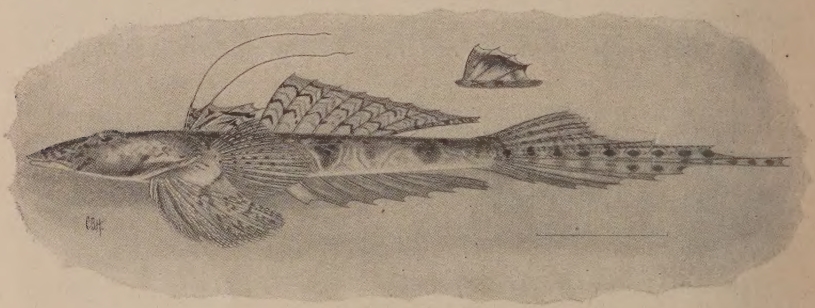

FIG. 3.—CALLIURICHTHYS VARIEGATUS.

the lower broad on each side; preoperculum with a short sharp spine directed backward, always shorter than the eye, the upper edge with small, sharp antrorse barbs, and the base in front with a short, sharp spine directed forward; top of the head behind the eyes forming a broad, rugosely striate patch. Gill openings small, round, on the upper surface of the body a short distance in front of the origin of the dorsal, as far apart as the space between the outer margins of the eyes, and a trifle nearer the origin of the pectoral than the posterior margin of the eye.

Origin of the spinous dorsal midway between or a little nearer the posterior margin of the eye than the origin of the soft dorsal; spines long, slender, and the first two produced into long filaments till they are equal to three-sevenths the length of the body; the dorsal spines are graduated from the first two, which are the longest; origin of the soft dorsal nearer the base of the caudal than the tip of the snout, the fin high, uniform, and the last ray the longest and produced; origin of the anal

between the second and third dorsal rays, lower than the soft dorsal, the last ray very long, produced, and reaching farther posteriorly than the tip of the last dorsal ray; origin of pectorals nearer the origin of the spinous dorsal than the origin of the soft dorsal by nearly three-fourths the distance between, broad, and forming an angle with the lower rays the shortest; ventrals broad, larger, longer, than the pectorals, the rays graduated to the inner which is the longest; caudal very long, strong, graduated above and below to the middle rays which are the longest and nearly equal to $1\frac{1}{2}$ in the body. Caudal peduncle long, broad, compressed, and the depth a little less than the eye. Lateral line with minute pores.

Color of male in alcohol dark brown above, with numerous rounded blotches and spots of pale brown margined more or less with deeper, and about six pale rather broad cross bars; a narrow dark brown bar across the snout above, several from the eye, and one across the operculum to the sides of the head; sides of the head, and trunk, with short narrow irregular pale bluish bars and spots edged with whitish, on the former often in pairs, the space between and on each side dark brown; the brown blotches of the flanks with one or two small jet black ocelli; lower surface of the body whitish, with a deep brown blotch on the under surface of the head between the branchiostegals; spinous dorsal grayish with blackish brown blotches and lines, a deep black blotch and several white lines posteriorly; soft dorsal pale, with alternate wavy lines of gray and black; anal grayish black, and the outer part of the last ray black; pectorals pale with small dark spots above; ventrals gray, space behind the first three rays deep black and the rest of the fin more or less speckled with blackish brown; caudal with six or seven blackish bars, and with many fine wavy bars, lower rays pale and plain. The female differs in having the dorsal spines without filaments, the caudal and body shorter, the color plainer without the black lateral ocelli, the anal fin whitish with a narrow black marginal band, and without a brown blotch on the underside of the head. Description from Nagasaki specimens, the largest male $6\frac{5}{16}$ inches.

This species is moderately common in the bay of Nagasaki, where our specimens were taken. Dr. Günther erroneously regards this species as the female of *Calliurichthys japonicus*.

(*variegatus*, variegated).

4. CALLIURICHTHYS DORYSSUS Jordan and Fowler, new species.

Head 3 to $3\frac{1}{2}$ in length; depth $7\frac{1}{2}$ to $10\frac{3}{4}$; D. IV-9; A. 9; P. 20; V. I, 5. Body elongate, compressed above and with the greatest depth about the anterior dorsal region; trunk broader than deep and tapering backward. Head compressed above so that its depth is $2\frac{1}{3}$ in its breadth; snout moderate, bluntly pointed, compressed, its depth $1\frac{2}{5}$

in its length, which is 3 in the head; bony ridge in front of the eye not conspicuous; eyes close together, on top of the head, directed upward, 1 to $1\frac{1}{2}$ in the snout, $2\frac{1}{3}$ to $3\frac{1}{3}$ in the width and 4 to $4\frac{1}{2}$ in the length of the head; mouth small, inferior, the upper jaw protruding, and the maxillary not reaching to the nostril; teeth in villiform bands in the jaws; lips rather thin, the lower broad on each side; preoperculum with a sharp spine directed backward equal to the eye, the upper edge with small, sharp, antrorse barbs and the base in front with a short, sharp spine directed forward; head entirely smooth above and without any asperities. Gill openings small, round, on the upper surface of the body a short distance in front of the origin of the dorsal, as far apart as the outer margins of the eyes, and much nearer the eye than the base of the pectoral.

Origin of spinous dorsal midway, or a little nearer to the posterior margin of the eye than the origin of the soft dorsal; spines long,

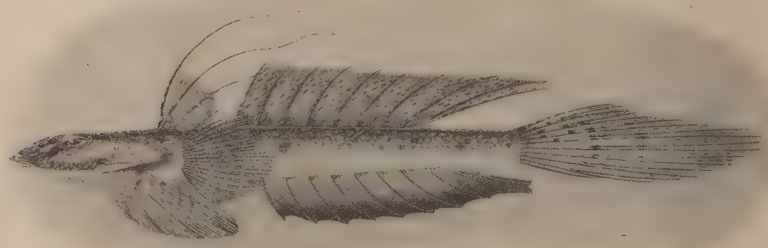

FIG. 4.—CALLIURICHTHYS DORYSSUS.

slender, produced into long filaments, the first the longest, graduated to the last, which is the shortest, and contained in the body about $1\frac{5}{6}$ times; origin of soft dorsal nearer the base of the last anal ray than the tip of the snout, the fin rising behind to the last ray, which is the longest; origin of the anal a little behind the second dorsal ray, the fin growing deeper behind to the last ray, which is the longest, and its tip reaching about as far as that of the last dorsal ray; origin of pectorals nearer the origin of the spinous dorsal than that of the soft dorsal; the middle rays produced into a point and the lower the longest; ventrals shorter than the head, longer than the pectorals, the inner rays the longest, and joined to the base of the pectorals in front by a membrane; caudal moderately long, the middle rays the longest and strongest. Caudal peduncle compressed, broader than the depth, which is less than the eye.

Color in alcohol brown above, with numerous rounded blotches and spots of pale brown margined more or less with deep brown, and

about six rather broad, pale, cross bars; on the sides of the trunk are about six dark brown blotches, lower surface of the body white; spinous dorsal gray with dark spots, the filaments barred even to near their tips, and several white ocelli on the lower part of the fin; soft dorsal pale, with numerous blackish specks; anal blackish, deeper toward the tips of the rays, and the base marked with few very pale blotches; pectorals with pale spots above; ventrals blackish gray with a few dark specks, and the tips of the rays white; caudal edged with blackish, and with six blackish cross bars made up of small spots. Color of the male and female not different, the latter with the spinous dorsal filaments, but the young without them, and the anal plain white, except a narrow blackish band on the lower half. Here described from specimens from Nagasaki, the largest 7¼ inches long.

Our many specimens are from Nagasaki, Wakanoura, and Aomori. The type is No. 7186, Leland Stanford Junior University Museum, Cotype, is in the U. S. National Museum. This species differs from the others of the genus in the smooth head and highly elevated dorsal spines.

(δορύσσος, spear-bearer.)

3. CALLIONYMUS Linnæus.

Callionymus LINNÆUS, Syst. Nat., 10th ed., 1758, p. 249 (*lyra*).

This genus includes Dragonets with the ventral fins entire, without detached ray, the gill opening reduced to a small foramen, opening upward, and the lateral line single; head triangular, depressed; eyes directed upward; preopercular spine very large, hooked at tip and with one or more recurved spines above; a small autrorse spine at its base below; opercle unarmed; sexual differences strongly marked. Species numerous, living on the bottoms in warm seas. In America the few species live at a considerable depth. In the Mediterranean, in India, and in Japan they are shore fishes, swarming in all bays and living in shallow water. In Japan they are especially abundant, forming a conspicuous part of the fish fauna.

(κάλλις, beauty; ὄνομα, name, an old appellation of some sea fish.)

a. Preopercular spine with but two recurved hooks at its tip.

b. Soft dorsal fin very high, its rays branched; a lunate black spot on membrane of last spine; D., IV–8; A., 7; dorsal spines graduated, the first elongate. *altivelis*, 5.

bb. Soft dorsal fin moderate, the rays not branched; first dorsal spine only much produced in the male; spinous dorsal in male with a black ocellus; female with the posterior half of the fin black; head rather broad, its width 3 in length ..... *lunatus*, 6.

aa. Preopercular spine with three or four recurved hooks above; soft dorsal moderate, its rays not branched.

c. Dorsal fins not joined by membrane.

d. First dorsal fan-shaped, the first and fourth spines being always longest.

e. First and last dorsal spines very slightly produced, even in males, so that the upper margin of the fin is merely lunate; male with a lunate black blotch on upper edge of spinous dorsal, female with a black ocellus; coloration nearly plain olive; no oblique black streaks on anal. *valenciennesi*, 7.

ee. First and last spines greatly elevated in the males, the second spine shortest; male with spinous dorsal blackish-brown with white reticulated lines; female with the first spine only much produced and with a large black ocellus on dorsal posteriorly; head rather narrow. *flagris*, 8.

dd. First dorsal with the first and second spines about equal, connected by membrane almost to their tips, the third longer, ending in a filament, the fourth shortest and also filamentous; spinous dorsal in males with several black ocelli, females unknown..... *calliste*, 9.

ddd. First dorsal with the first spine longest.

f. Spinous dorsal (in female?), uniformly colored; D., IV–10; A., 10. *huguenii*, 10.

ff. Spinous dorsal with white spots and lines, its posterior edge blackish; dorsal spines graduated, the first longest, the others regularly shortened; interorbital space broad; the eyes well separated; anal fin with dark wavy cross bars, very sharply defined in the male. *beniteguri*, 11.

cc. Dorsal fins connected by membrane; second and fourth spines greatly elongate, reaching caudal; spinous dorsal in male mottled and striated. *virgis*, 12.

5. CALLIONYMUS ALTIVELIS Schlegel.

BENITEGURI (RED NET-CATCH OR DRAGONET).

Callionymus altivelis SCHLEGEL, Fauna Japonica, Poiss., 1845, p. 155, pl. LXXIX, fig. 1; Bay of Omura (about 15 miles north of Nagasaki).

Head about $2\frac{2}{5}$ (in fig.) in length; depth about $6\frac{1}{2}$ (in fig.); D. IV–8; A. 7; P. 19; V. I, 5. Snout a little convex; the upper border of eyes elevated, and the interorbital space very narrow and concave; preopercular spine with a single large hook above; gill opening round, and lateral; first dorsal opposite the gill opening, the first spine equal to the caudal, the last one-third the length of the first and without a membrane uniting it with the back; height of the second dorsal nearly equal to the head, and all its rays branched; anal beginning below the first third of the soft dorsal, much lower than the same, and, with the exception of the last, all the rays are simple or unbranched; pectorals rounded.

In life brick red; the back marbled with pale brown, below whitish; spinous dorsal marbled with yellow, reddish-brown and greenish, the last color forming a large spot above posteriorly; soft dorsal yellow, with 6 or 7 oblique rose-colored bars; anal pale red, becoming deep behind; membranes of pectorals, ventrals and caudal blue, the rays pale red, the latter with 5 or 6 large, transverse, yellow bars, and the lower margin tinted with red. Length, 8 inches. Bay of Omura. (Schlegel.)

This strongly marked species is known only from Schlegel's account, no specimens having been taken by later writers. Its red coloration, the reduction of the number of hooks on the preopercular spine, and the great height of the soft dorsal should distinguish it.

Omura, the type locality, is about 15 miles north of Nagasaki.

(*altus*, high; *velum*, sail.)

6. CALLIONYMUS LUNATUS Schlegel.

Callionymus lunatus SCHLEGEL, Fauna Japonica, Poiss., 1845, p. 155, pl. LXXVIII, fig. 4; Nagasaki (male).—GÜNTHER, Cat. Fish. Brit. Mus., III, 1861, p. 146 (copied).

Callionymus inframundus GILL, Proc. Ac. Nat. Sci. Phila., 1859, p. 129; Japan (female; greenish, marbled with white, first dorsal blackish).

Head $3\frac{1}{4}$ in length; depth, 10; D. IV–9; A. 9; P. 19; V. I, 5.

Body elongate and compressed above; trunk broader than deep and tapering backwards. Head compressed so that its depth is $2\frac{1}{3}$ its width; snout rather pointed, compressed, its length equal to the eye,

FIG. 5.—CALLIONYMUS LUNATUS.

and about $\frac{3}{4}$ its own width; eyes close together, on top of the head, directed upward, $3\frac{2}{3}$ in the length and $2\frac{2}{3}$ in the width of the head; mouth small, inferior, the upper jaw protruding, and the maxillary not reaching the eye; teeth in villiform bands in the jaws; lower lip rather thick, and broad on each side; preopercular spine with two large teeth turned upward, and a short spine projecting from its base forward, embedded in the skin; head smooth. Gill openings round, nearer the origin of the dorsal than the posterior margin of the eyes, and nearer the latter than the origin of the pectoral.

Origin of the spinous dorsal midway or a little nearer the posterior margin of the eyes than the origin of the soft dorsal; the dorsal spines slender, the first produced into a long filament so that its entire length is a little more than the entire space between its own origin and the tip of the snout, or a little less than that between the former and the base of the caudal; the others are about equal; soft dorsal high, its origin nearer the tip of the snout than the base of the caudal, and the last ray

the longest; anal lower than soft dorsal, its origin between the second and the third dorsal rays, and its last ray produced; pectorals with an angle behind, the middle rays the longest, and the lower the shortest; ventrals a little longer than the pectorals, and their outer rays the shortest; caudal about equal to the head, upper rays little shorter than the middle, while the lower are graduated; caudal peduncle greatly compressed, its depth about $\frac{2}{3}$ the eye.

Color of male in alcohol brown above, beautifully mottled, and with minute spots, some forming rings and blotches with light centers, and traces of several broad crossbars; sides of the trunk with five or six dark brown blotches; lower surface of the body white; spinous dorsal gray; a jet black ocellus behind the last spine, and in front each spine marked with darker and white; soft dorsal with three narrow brown bands; anal with a median blackish band, and its edge white; pectorals with a few pale spots above; ventrals grayish, the edges and the tips of the rays whitish; caudal with about four or five crossbars made up of small spots, its edge below white, above which is a broad black band. The female is much like the male but has the spinous dorsal low, the first ray not longer than the others, and with much black posteriorly; the anal fin pale; never an ocellus.

Our description above is from examples from Nagasaki and Wakanoura, the largest about $5\frac{7}{16}$ inches in length. We have specimens from Tsuruga, Wakanoura, Nagasaki, Same, and Niigata. It is evidently generally distributed along the coast.

The male is well distinguished by the high spines and the black spot on the posterior membrane. The female resembles the young of *C. valenciennesi*, but the black spot on the dorsal occupies nearly half the fin.

(*lunatus*, crescent shaped.)

7. CALLIONYMUS VALENCIENNESI Schlegel.

NEZUMEGOCHI (RAT KOCHI); NEZUPO (RAT TAIL).

Callionymus japonicus CUVIER and VALENCIENNES, Hist. Nat. Poiss., XII, p. 299; Japan, coll. Langsdorf (not of Houttuyn).

Callionymus reevesi RICHARDSON, Voy. Sulphur, Fishes, 1844, p. 60, pl. XXXVI (female; on a drawing made in Canton not type).

Callionymus valenciennesi SCHLEGEL, Fauna Japonica, Poiss., 1845, p. 153, pl. LXXVIII, fig. 3; Nagasaki (figure very poor).

Callionymus punctatus RICHARDSON, Ichth. China, 1846, p. 210 (after *C. japonicus* Cuvier and Valenciennes).

Callionymus richardsoni BLEEKER, Nat. Tyds. Ned. Ind., VI, 1854, Japan, p. 414; Nagasaki.—BLEEKER, Verh. Bat. Gen., XXVI, 1857, Japan, III; Nagasaki.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1900, p. 370; Tokyo.

Callionymus curricornis GÜNTHER, Cat. Fish., III, 1861, p. 145; China.—ISHIKAWA, Prel. Cat., 1897, p. 37; Tokyo, Boshu.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1900, p. 370; Yokohama (not of Cuvier and Valenciennes, from Bourbon Island).

Head $3\frac{1}{3}$ in length; depth 11; D. IV–9; A. 9; P. 20; V. I, 5. Body elongate and compressed above; trunk broader than deep, and tapering backward. Head compressed, its width two-thirds its length, and its depth $2\frac{1}{5}$ in its width; snout rather long, blunt, compressed, much greater than the eye, and its depth two-thirds its length; eyes close together, on top of the head, directed upward, $1\frac{1}{2}$ in snout, $4\frac{1}{2}$ in the head, and $3\frac{1}{2}$ in its width; mouth small, inferior, the jaws nearly equal, and the maxillary not reaching the eye; teeth in villiform bands in the jaws; lower lip thick, and broad on each side; preopercular spine with 4 large teeth turned upward, and a short spine projecting from its base forward, embedded in the skin; head smooth. Gill openings round, nearer the origin of the dorsal than the posterior margin of the eyes, and nearer the latter than the origin of the pectoral.

Spinous dorsal midway between the origin of the soft dorsal and

FIG. 6.—CALLIONYMUS VALENCIENNESI.

the middle of the eye; dorsal spines slender and the first and last the longest, about equal, and about a third again as long as the two median ones, so that the edge of the fin is deeply emarginate; soft dorsal high, the first ray somewhat higher than the others, excepting the last, which is very long and produced; anal rather low, lower than the soft dorsal, but its last ray produced till it is equal to two-thirds the length of the last dorsal ray; pectorals with the middle rays the longest, and produced into an angle behind; ventrals a little longer than pectorals; caudal with the middle rays the longest, graduated above and below. Caudal peduncle compressed, and about equal to the eye.

Color of male in alcohol brown above, mottled with minute spots forming rings and blotches with light centers, and traces of several broad crossbars; narrow pale bluish lines on the sides of the head; sides of the trunk with 5 dark-brown blotches, and numerous light-brown narrow lines inclined forward; lower surface of the body white, silvery

on the lower part of the sides; spinous dorsal gray, with white lines, and blotches, the upper margin generally with a narrow black crescent; soft dorsal gray, spotted with white, and also with a few dark brown spots; anal blackish, deep at the margin, and near which is a narrow longitudinal blackish line; pectorals with small pale spots above; ventrals grayish; caudal gray, with dark spots rather large in the center, and its lower rays blackish. The female differs from the male in color, as the black crescent of the spinous dorsal is replaced by a large black ocellus below, and posteriorly the lower rays of the caudal are white; the narrow oblique lines of the sides are absent, and the anal fin is pale or white.

This description from a large series of specimens from Nagasaki, the largest 8⅝ inches, though we have a large specimen, 10½ inches, from Tokyo.

This species is subject to some variation in color, and the third and fourth dorsal spines are sometimes equal, especially in females, but it may be easily recognized by the lunate margin of the spinous dorsal.

This species is by far the most abundant of the genus in Japan, being found everywhere in sandy bays to the southward of Hakodate and brought in daily to all markets. Our specimens are from Hakodate, Matsushima, Misaki, Yokohama, Tokyo, Enoshima, Tsuruga, Wakanoura, Onomichi, Kobe, Kawatana, and Nagasaki. The sexes differ considerably, but the fan shape of the spinous dorsal fin, its first and last spines being longest, with its peculiar coloration, are always diagnostic.

The species is certainly very close to *Callionymus curvicornis* from the Isle of Bourbon, but the two should not be united without comparison of specimens.

(Named for Achille Valenciennes.)

8. CALLIONYMUS FLAGRIS Jordan and Fowler, new species.

Callionymus japonicus Jordan and Snyder, Proc. U. S. Nat. Mus., 1900, p. 370; Yokohama (not of Houttuyn).

Head 3⅓ in length; depth 10½; D. IV–9; A. 9; P. 19; V., I, 5. Body elongate, compressed above, the trunk broader than deep and tapering backward. Head compressed, rather narrow, its width two-thirds its length, and its depth 2 in its width; snout rather long, pointed, compressed, much greater than the eye, and its depth a little less than its length; eyes close together, on top of the head, directed upward, a little over 1 in the snout, about 4½ in the head's and 2⅔ in its width; mouth small, inferior, the lower jaw projecting a little, and the maxillary reaching a little beyond the nostril; teeth in villiform bands in the jaws; lower lip thick, and broad on each side; preopercular spine with 2 or 3 sharp teeth turned upward, and a sharp spine projecting forward from its base embedded in the skin; head smooth. Gill

opening rounded, nearer the origin of the dorsal than the posterior margin of the eyes, and nearer the latter than the origin of the pectoral.

Spinous dorsal midway between the origin of the soft dorsal and the middle of the eye or its posterior margin; dorsal spines all very long and slender, all produced into long, slender filaments, the first very long, sometimes reaching the base of the caudal, the second the shortest, the third longer and closely joined to the last above, which is still longer; dorsal rather high, and the last ray greatly elongated, so that it is nearly equal to the base of the fin; anal beginning a little before the third dorsal, and its last ray about equal to two-thirds the length of the last dorsal ray; pectoral with its median rays the longest, and the angle somewhat rounded; ventrals very long, and extending nearly to the tips of the pectorals; caudal long, about one-half the length of the body, and its middle rays produced into slender filaments. Caudal peduncle compressed, its breadth greater than its depth, which is two-thirds the eye.

Color of males in alcohol, rich brown above, mottled with minute

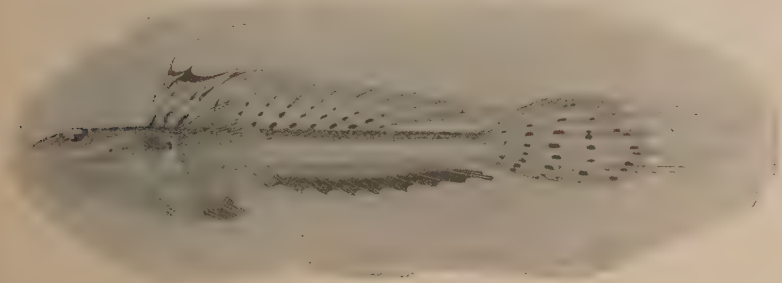

FIG. 7.—CALLIONYMUS FLAGRIS.

spots forming rings or blotches with pale centers and traces of several broad crossbars; several pale bluish bars on the sides of the head; sides of the trunk with 5 dark brown blotches; lower surface of the body white; spinous dorsal white, with a number of large black spots, and generally a blackish marginal crescent above; soft dorsal gray, the basal portion with reticulating white lines inclosing large blackish-brown spots; below and above are small pale spots; anal fin gray, becoming blackish toward its margin; pectorals with small spots above, ventrals gray, the outer portion of the rays blackish, and the margin of the fin gray; caudal gray, the middle and lower half with 5 bars of broad gray-black spots. The female differs from the male chiefly in having the dorsal spine short, the first a little longer than the others, and without filaments; the last dorsal ray is short, and the caudal lacks the filaments. The color is more somber, and the anal and the margin of the ventrals are pale. Here described from specimens from Tsuruga and Tokyo, the largest reaching 7½ inches.

Type No. 7187, Leland Stanford Junior University Museum; cotypes are in the U. S. National Museum.

We have many examples from Aomori, Tsuruga, Kobe, and Nagasaki; also a series from Tokyo from Prof. Otaki and the U. S. Fish Commission steamer *Albatross* dredgings at Station 3722 in Owari Bay and Station 3777 in Matsushima, Bay of Kinkwasan. We have also a small specimen from Tsuruga Bay. It seems to inhabit rather deeper waters than *Callionymus valenciennesi*.

(*flagris*, under the lash.)

9. CALLIONYMUS CALLISTE Jordan and Fowler, new species.

Head 3¼ in length; depth 7½; D. IV–8; A. 7; P. 17; V. I, 5. Body elongate, compressed above, the trunk broader than deep and tapering backward. Head compressed so that its depth is two-thirds its width;

FIG. 8.—CALLIONYMUS CALLISTE.

snout rather pointed and compressed; eyes close together on top of the head, about 1¼ in the snout, 4 in the length, and 3 in the width of the head; mouth small, the jaws about equal and the maxillary not reaching the eye; teeth in villiform bands in the jaws; lips rather thin; peropercular spine with three teeth, and a short spine at the base in front, directed forward; head smooth above. Gill opening round, a little farther apart than the distance between the outer margins of the eyes, and about midway between the posterior margin of the latter and the origin of the pectoral.

Origin of the spinous dorsal about halfway between the first third of the eye and the origin of the soft dorsal; dorsal spines long, slender, rather firm, the first and second about equal, a little longer than the base of the soft dorsal, the third longer than either, and its extremity filamentous, the last the shortest, and its extremity also filamentous, the last the shortest, and its extremity also filamentous; the

membrane of the spinous dorsal extends almost to the extremities of the first and second spines; soft dorsal of about uniform height, with the last ray the longest; origin of the anal behind the second dorsal ray, the fin high posteriorly, the last ray produced till much longer than the last dorsal ray, and extending beyond it; pectoral broad, three-fourths the length of the first dorsal spine; ventral shorter than the first dorsal spine; caudal with the middle rays the longest, and graduated above and below, so that the fin is pointed and $2\frac{1}{3}$ in the body; caudal peduncle compressed, and about equal to the eye.

Color in alcohol, dark brown above, with many dark reticulations, mottlings, and 5 narrow dark-brown crossbars; below white, along the base of the anal spotted with brown, and the sides with blackish; several dark bars and light-brown lines on the sides of the head; spinous dorsal gray, with several black ocelli at the base, and marked with darker gray lines and spots; soft dorsal gray, the rays spotted with dark gray brown; anal grayish white, its margin blackish, and the fin mottled behind with grayish; pectoral rays spotted with brownish; ventrals gray, with a broad grayish-black band near the margin, which is narrowly whitish, the fin with narrow whitish cross lines, and the inner rays more or less speckled with grayish; caudal gray, the middle rays with rather large blackish spots, and above and below with small whitish spots. This description from 3 males taken at Misaki, the longest $3\frac{7}{8}$ inches.

Type No. 7188, Leland Stanford Junior University Museum; cotype is in the U. S. National Museum.

Of this species, the most strikingly colored of the group, we have several specimens from the rock pools of Misaki.

(*καλλίστη*, very beautiful.)

10. CALLIONYMUS HUGUENII Bleeker.

Callionymus huguenii BLEEKER, Act. Soc. Sc. Indo. Neerl., V, 1858, Japan, V, p. 7, pl. II, fig. 1; Nagasaki.—GÜNTHER, Cat. Fish, III, 1861, p. 145 (copied).

Head $3\frac{1}{3}$ in length; depth $7\frac{1}{2}$; D. IV–10; A. 10; P. 17; V. I, 5. Body elongate, depressed, and its greatest breadth about $4\frac{1}{2}$ in its length. Head with its breadth $1\frac{1}{3}$ and its depth $2\frac{1}{3}$ to $2\frac{1}{4}$ in its length; eyes close together, 3 in the head; snout less than its width at base; preopercular spine with 3 teeth. Gill opening superior. Origin of the spinous dorsal behind the gill opening, the spines slender, filamentous, the first the longest, and much longer than the head; soft dorsal highest posteriorly; anal highest posteriorly and the last ray the longest; pectoral about 5 in the body; ventral about $5\frac{1}{3}$ in the body; caudal strongly pointed, $3\frac{1}{3}$ to $3\frac{1}{4}$ in the total length.

Body above rosy-green, below whitish; head, back, and sides above variagated with deep olive blotches and pearly ocelli; sides of the head with pale-blue ocelli, the rings violet; fins pale rosy-green, the

spinous dorsal plain; the soft dorsal with numerous small brown spots; margin of anal blackish brown; the pectoral plain; the ventrals with violaceous diffused on the outer portion of the inner rays, and the caudal with 5 or 6 series of transverse spots.

Length 79″ (about 3⅛ inches); Nagasaki (Bleeker).

This species is known to us from Bleeker's description only.

11. CALLIONYMUS BENITEGURI Jordan and Snyder.

Callionymus benitegurí JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1900, p. 376, pl. XVII; Tokyo Bay.

Head 3 in length; depth 10; D. IV–9; A. 9; P. 19; V. I, 5. Body elongate, compressed above, the trunk broader than deep, and tapering backward. Head compressed so that its depth is 2½ in its width; snout broad, compressed, and its depth greater than the eye; the interorbital space is broader than that of any other species of this genus; the eyes well separated, about 5 in the length and 4½ in the width of the head; mouth small, inferior, the upper jaw projecting, and the maxillary reaching as far posteriorly as the nostril; teeth in villiform bands in the jaws; lower lip rather thick, and broad on each side; preopercular spine with about 3 large teeth turned upward and a short spine projecting from its base forward, embedded in the skin; head smooth. Gill openings round, nearer the origin of the dorsal than the posterior margin of the eyes, and midway, or nearer the latter than the origin of the pectoral.

Origin of spinous dorsal a little nearer, or midway between, the posterior margin of the eyes than the origin of the soft dorsal; the spines rather short, slender, the first two ending in filaments of about equal length, and about as long as the height of the fin; sometimes soft dorsal of uniform height, and the last ray the longest and produced till it is much longer than the last anal ray; origin of the anal a little in front of the third dorsal ray; pectorals very broad, and with a blunt angle behind; ventrals large, nearly equal to the head; caudal long, the middle rays produced.

Color of male in alcohol deep brown above, mottled, and with minute dark spots and lines, some forming rings around pale spots and blotches, and traces of about six pale broad crossbars; sides of the trunk with six brown blotches; lower surface of the body white; spinous dorsal gray, with white spots and lines, and blackish near its margin posteriorly; soft dorsal gray with numerous white ocelli, and three rows of longitudinal blackish spots; anal dark gray with oblique wavy white lines; pectoral with small brown spots above; ventral grayish brown, becoming blackish along the lower margin of the fins; caudal gray, with many white ocelli and black spots, and its lower margin broadly blackish. The female differs from the male chiefly in having pale colors, the anal being very pale, the ventrals pale with a

light edge, the dorsal filaments generally shorter, and the spinous dorsal generally with more or less black posteriorly.

Here described from specimens from Tokyo, the largest 8¼ inches long. Our specimens are from Tokyo, the original types collected by Otaki, and many others taken by Jordan and Snyder. Others are from Misaki, Otaru, Wakanoura, Kobe, Hakodate, Aomori, Hiroshima, Nagasaki, and Matsushima Bay.

This species, variable in its coloration, is easily distinguished by its broad interorbital space.

This species is very abundant throughout almost all parts of Japan, being scarcely less common than *Callionymus valenciennesi*, though living in rather deeper water. The male is well distinguished by the form of the dorsal fin, the first two spines being filamentous, the others progressively shorter. A still better diagnostic mark is the color of the anal fin, which has dark gray or black oblique crossbars on the membranes. These marks are faint or wanting in the female, but in both sexes the dorsal spines are progressively shortened from the first.

(*benitegurí*, vernacular name of *Callionymus altivelis*: *beni*, red; *teguri*, net-catch, a name applied to small fish.)

12. CALLIONYMUS VIRGIS Jordan and Fowler, new species.

Head 3 in length; depth 7¾; D. IV–9; A. 9; P. 19; V. I, 5. Body elongate, compressed above, the trunk broader than deep and tapering backward. Head compressed, so that the depth is about one-half its width; snout pointed, compressed, and equal to the eye; eyes large, close together, 4 in the length, and 3 in the width of the head; mouth rather large, and the maxillary extending to within a short distance of the eye; teeth in villiform bands in the jaws; lips moderate; preopercular spine with 3 teeth above, and a short spine in front directed forward; head smooth above. Gill openings small, round, as far apart as the distance between the outer margins of the eyes, and nearer the posterior margin of the latter than the origin of the pectorals.

Origin of the spinous dorsal nearer the posterior margin of the eye by two-thirds its diameter than the origin of the soft dorsal; dorsal spines all very long, slender, and filamentous, the first and third equal, but shorter than the second and fourth, which reach the base of the caudal; the membrane of the spinous dorsal high, and joined from behind the last spine to the first dorsal ray; soft dorsal high in front and posteriorly, the margin concave or emarginate, and the last ray produced to the base of the caudal; anal low and the rays produced posteriorly, but the last not reaching the caudal; pectorals broad, the middle rays produced, with a sharp angle behind; ventrals about equal to the head; caudal subtruncate, the margin slightly convex, and the upper rays nearly as long as the middle; caudal peduncle compressed, about two-thirds the eye.

Color in alcohol brown above, with dark brown reticulating lines inclosing pale blotches and spots; below white, the sides light, with rather deep brown reticulations; spinous dorsal gray, dark in front, and behind the third and fourth spines a light vertical streak; soft dorsal pale brown, with a brown blotch at the base of each ray; anal pale, with pale brown streaks on the membrane; pectorals very pale, with small brown spots above; ventrals pale, more or less broadly

FIG. 9.—CALLIONYMUS VIRGIS.

spotted with brown, and gray-brown, with 3 or 4 gray crossbars, and a broad blackish band along the lower edge. Described from a single small specimen $2\frac{11}{16}$ inches long, from Misaki.

Type No. 7189, Leland Stanford Junior University Museum.

This species, known only from the specimen described above, is easily distinguished from all others of the genus by its exceedingly long dorsal spines, the dorsal fins being joined together by a membrane, and the subtruncate caudal.

(*virgis*, under the whip.)

SUMMARY.

Family I. DRACONETTIDÆ.

I. *Draconetta* Jordan and Fowler.

1. *xenica* Jordan and Fowler; Suruga Bay.

Family II. CALLIONYMIDÆ.

II. *Calliurichthys* Jordan and Fowler.

2. *japonicus* (Houttuyn); Nagasaki, Wakanoura.
3. *variegatus* (Schlegel); Nagasaki.
4. *doryssus* Jordan and Fowler; Nagasaki, Wakanoura.

III. *Callionymus* Linnæus.

5. *altivelis* Schlegel.
6. *lunatus* Schlegel; Wakanoura, Nagasaki, Tsuruga, Same, Niigata, Hakodate.
7. *valenciennesi* Schlegel; Tsuruga, Tokyo, Yokohama, Matushima, Misaki, Wakanoura, Enoshima, Kobe, Onomichi, Kawatana, Nagasaki.
8. *flagris* Jordan and Fowler; Aomori, Matsushima Bay, Tokyo, Kobe, Tsuruga, Nagasaki, Owari Bay, Suruga Bay.
9. *calliste* Jordan and Fowler; Misaki.
10. *huguenii* Bleeker; Nagasaki.
11. *benitegari* Jordan and Snyder; Hakodate, Otaru, Matsushima, Tokyo, Misaki, Wakanoura, Kobe, Hiroshima, Nagasaki.
12. *virgis* Jordan and Fowler; Misaki.